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IS 15541 (2005): Low cement and ultra low cement castables for general purposes [MTD 15: Refractories]

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Indian Standard

LOW CEMENT AND ULTRA LOW CEMENT CASTABLES FOR GENERAL PURPOSES — SPECIFICATION

ICS 81.080

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

February 2005 Price Group 2

Refractories Sectional Committee, MTD 15

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Refractories Sectional Committee, had been approved by the Metallurgical Engineering Division Council.

This standard has been prepared for specifying the requirements of low cement and ultra low cement castables for general purpose. Six grades of low cement castables and two types of ultra low cement castables and their methods of sampling have been specified in this standard.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

LOW CEMENT AND ULTRA LOW CEMENT CASTABLES FOR GENERAL PURPOSES — SPECIFICATION

1 SCOPE

This standard covers the requirements of low cement castables and ultra low cement castables for general purpose. The specific uses may be decided by mutual understanding between the manufacturer and purchaser. The scope also describes the method of sampling.

2 REFERENCES

The following standards contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions were valid. All standards are subject to revision, and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standard indicated below:

IS No.	*Title*
1527 : 1972	Methods of chemical analysis of high silica refractory materials (*first revision*)
1528	Method of sampling and physical tests for refractory materials:
(Part 1) : 1980	Determination of pyrometric cone equivalent (PCE) or softening point (*second revision*)
(Part 14) : 1974	Sieve analysis (*first revision*)
(Part 16) : 1991	Determination of thermal conductivity up to 1250°C of dense and insulating refractory products according to the hot wire parallel method
4041 : 1987	Glossary of terms relating to refractory materials
10570 : 1983	Method for testing refractory castables

3 TERMINOLOGY

3.1 For the purpose of this standard, the following definitions in addition to those given in IS 4041 shall apply.

3.2 Low Cement Castables — Mixture of graded refractory agreegates with high alumina cement in order to have total CaO content between 1-2 per cent. The plasticisers may also be incorporated in the low cement castables.

3.3 Ultra Low Cement Castables — Mixture of graded refractory agreegates with high aluminina cement in order to have total CaO content between 0.31 to 0.5 per cent, the plasticisers may also be incorporated in the ultra low cement castables.

3.4 Lot — In any consignment, all the containers containing low cement and ultra low cement castables of the same type and grade, manufactured by the same firm under similar conditions of production shall be grouped together to constitute a lot. The maximum mass of any lot however shall be limited to 25 tonnes.

4 SAMPLING AND TEST PIECE PREPARATIONS

4.1 For the complete series of test a minimum quality of about 50 kg is required as sample. As those are normally supplied in 50 kg containers, the number of containers mentioned below shall be released at random on the following basis:

Lot Size (1)	*No. of 50 kg Containers/ Bags to be Selected as Sample*[1)] (2)
Up to and including 1 tonne	1
Over 1 tonnes and up to and including 4 tonnes	2
Over 4 tonnes and up to and including 25 tonnes	5

[1)] Each container/bag sample shall be made available from at least 10 locations randomly.

4.2 The selected containers/bags shall be emptied on a suitable dry surface and the material be thoroughly mixed and reduced to 50 kg by coning and quartering. This final sample shall be divided equally into eight test samples by successive coning and quartering method. These test samples shall be used for various physical tests, sieve analysis, bulk density, permanent linear change, pyrometric cone equivalent, modulus of rupture, cold crushing strength and thermal conductivity.

4.3 Preparation of Test Pieces

The method of preparing test pieces of the material has a marked effect on their properties and it is necessary to use a standard procedure.

4.3.1 *Apparatus*

The apparatus used for the specimen preparation for bulk density, firing shrinkage, modulus of rupture and cold crushing strength are:

a) *Moulds* — as per **7.1.1** of IS 10570.
b) *Planetary bowl mixer* — as per **7.1.3** of IS 10570.
c) *Vibrating table* — as per **7.1.4** of IS 10570.
d) Drying oven.

4.3.2 *Test Pieces*

The test pieces used for the tests prescribed in **4.2** shall be in the form of bar 40 mm × 40 mm × 160 mm. These test pieces shall be cast using gang mould of three bars as per IS 10570. The consistency of the material, for the test pieces, shall be as per instructions given by manufacturer.

When shaping is completed the moulds with compacted test specimens are kept for 24 h in mould. After 24 h, the test pieces are removed from the mould and placed for drying at 110°C in an oven to constant weight. After drying, the test pieces are cooled to room temperature and dimensions are measured.

In special cases, the curing schedule as recommended by the manufacturers may be adopted.

5 CHEMICAL ANALYSIS

5.1 Chemical analysis, for low cement castable when carried out in accordance with IS 1527 shall be as given in Table 1.

5.2 Chemical anlaysis for ultra low cement castable when carried out in accordance with IS 1527 shall be as given in Table 2.

6 PHYSICAL PROPERTIES

6.1 The requirement of physical tests for low cement castable is given in Table 1.

6.2 The requirement of physical tests for ultra low cement castables is given in Table 2.

6.3 Maximum Grain Size

Wet sieve anlaysis for castables, shall be carried out in accordance with IS 1528 (Part 14). Grading shall be as per agreement between the manufacturer and the purchaser.

6.4 Flow properties shall be tested as given in Annex A of IS 10570.

6.5 Bulk density shall be determined as per method specified in **8** of IS 10570.

6.6 Cold crushing strength shall be determined as per specified in **10** of IS 10570.

6.7 Permanent linear change shall be determined as per method specified in **11** of IS 10570.

6.8 Thermal conductivity test shall be carried out in accordance with IS 1528 (Part 16) of any other suitable method can be used as agreed between the manufacturer and the purchaser.

7 DETERMINATION OF PYROMETRIC CONE EQUIVALENT (PCE)

7.1 The test shall be carried out in accordance with IS 1528 (Part 1).

8 PACKING

8.1 These castables shall be packed in polythene lined HDPE bags/containers of suitable weights.

9 MARKING

9.1 All the bags shall be marked with:

a) Manufacturers name, product name, net weight; and
b) Month and year of manufacture.

Table 1 Requirement for Low Cement Castable

(*Clauses* 5.1 *and* 6.1)

Grade (1)	**45** (2)	**60** (3)	**70** (4)	**80** (5)	**90** (6)	**95** (7)
Chemical Analysis (weight percent)						
Al_2O_3, *Min*	45	60	70	80	90	94
SiO_2, *Max*	48	35	25	13	06	4.2
Fe_2O_3, *Max*	1.5	1.5	1.5	1.8	1.0	0.3
TiO_2, *Max*	2.4	2.6	2.8	3.3	1.2	Traces
CaO, *Max*	2.0	2.0	2.0	2.0	1.7	1.2
Physical Properties						
MOR at 1 400°C kgf/cm^2	50	50	50	50	60	60
Maximum Grain Size, mm	6	6	6	6	6	6
Water for Casting, percent	4.8-5.5	4.7-5.4	4.0-4.6	3.8-4.5	4.2-5.0	4.0-4.8
B.D. (gm/cc) at 110°C/24 h, *Min*	2.3	2.6	2.65	2.9	3.0	3.1
C.C.S. kg/cm^2, *Min*						
110°C/24 h	700	750	750	800	950	1 000
1 100°C/3 h	900	900	950	1 050	1 100	1 100
1 500°C/3 h	1 000	1 000	–	–	–	–
1 5 50°C/3 h	–	–	1 000	1 150	1 200	1 250
Refractories Orton/°C, *Min*	32/1 717	36/1 804	36/1 804	37/1 820	37/1 820	38/1 835
PLC (percent)						
1 100°C/3 h, *Max*	±0.30	±0.30	±0.30	±0.20	±0.30	±0.30
1 500°C/3 h, *Max*	±1.0	±1.0	–	–	–	–
1 550°C/3 h, *Max*	–	–	±1.0	±1.5	±0.80	±0.80
Thermal Conductivity (kcal/m/h/°C)						
400°C	0.85	0.95	1.15	1.70	2.20	2.25
600°C	1.05	1.10	1.25	1.75	2.30	2.30
800°C	1.20	1.25	1.30	1.80	2.35	2.35
Storage Life (months)	6	6	6	6	6	6

Table 2 Requirement for Ultra Low Cement Castables

(*Clauses* 5.2 *and* 6.2)

Type (1)	**90 Percent** (2)	**95 Percent** (3)
MOR at 1 400°C	60	60
Chemical Analysis (weight percent)		
Al_2O_3, *Min*	90	95
Fe_2O_3, *Max*	1.5	0.5
CaO, *Max*	0.5	0.5
Water, percent	4-4.5	4-4.5
CCS kg/cm^2, *Min*		
110°C/24 h	400	200
1 100°C/3 h	900	800
1 550°C/3 h	1 100	1 200
MOR		
110°C/24 h	50	50
1 100°C/3 h	150	150
1 550°C/3 h	200	220
PLC, percent		
1 100°C/3 h	±0.3	±0.3
1 550°C/ 3 h	±1	±1
Storage life (months)	6	6

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